benzole) is poured in, and this not too carefully, since partial admixture will serve to expedite the process. The vessel is now left to stand for a few hours or over-night. In the morning the change in the specific gravity of the column of fluid will be found to increase *uniformly* on passing from the top downwards. To make certain of this three small indexes of different specific gravities, say 2·15, 2·03, and 1·98, are thrown in: naturally they sink till they each reach that level in the column where the specific gravity is identical with their own—"their own level," as we may briefly term it. The distances between them may be determined by bringing them successively into the focus of the microscope, and then reading off the position of the edge of the microscope slide by means of two parallel scales attached to the stage of the instrument.

If it be found that these distances are exactly proportional to the known differences of specific gravity, then the increase in density of the column must be uniform. It will save arithmetic if the distances and densities be referred to two rectangular axes, and a curve constructed; evidently when the change in density is uniform, the curve will be a straight line.

The sponge spicules are next introduced (in practice they are added at the same time as the indexes), and, like the indexes, sink to their own level. The position of this is read off as in the case of the indexes, and being referred to the axis of distances in the diagram, the specific gravity will be found on the corresponding axis of density. In this way it is easy to determine the specific gravity of individual spicules, and with a certainty that does not always attach to specific gravity determinations on large bodies by ordinary methods. The specific gravity of the spicules as a result of actual experiment is found to be 2·036, the great bulk of them floating at a level indicating this, but individual examples may sink to 2·09, while others do not fall below the level of 2·02.

It is only rarely that one needs to employ a microscope in this method; usually a test tube serves admirably to hold the heavy fluid, and a graduated glass mirror affords the speediest means of reading off the distances of the levels. So easy, accurate, and sure, has experience shown this method to be, that I now use it whenever practicable in preference to any other: unfortunately its range is limited to specific gravities below 3·45.

The indexes may be small fragments of minerals, or chemically pure substances of known density, such, for example, as yellow phosphorus (1·85), sulphur crystallized from carbon disulphide (2·07), and the like; or little floats may be made by manipulating short lengths of capillary glass tube. The ends of the bit of tube are successively sealed, the last to be fused generally blowing out into a little bubble during the process, and thus giving a form to the float which causes it to assume the vertical position when suspended in the heavy fluid. The quantity of solid glass in the float as compared with hollow, is determined chiefly during the sealing of the first end, since this merely fuses together without blowing out. Having constructed a good supply, some dozens, of these floats, they are thrown into a diffusion column along with three mineral indexes of carefully determined density: by reference to these, the specific gravity of each float can be found, and it can then be fished out from the fluid with a dipping tube, and preserved in a labelled box for future use.

The density of fluids can be ascertained in the same way as that of solids; but if the fluid be watery, an oily fluid such as methylene iodide, with benzole to dilute it, must be used for the diffusion column; while if it be oily, the diffusion column must be an aqueous solution, it may be of cadmium-boro-tungstate, or some other heavy salt.

There is, finally, one other case in which density can be determined by this method, while all others fail: given a gelatinous precipitate, like some of the silica hydrates, in which one has a sponge of loosely combined hydrate with additional water mechanically present filling the meshes, to find the specific gravity of the hydrate. This is not possible by ordinary methods, for one cannot be sure that no combined water is lost in the process of drying, which must precede the application of gravimetrical processes. But if a small clot of the gelatinous substance be introduced into a diffusion column, the mechanically mixed water will slowly diffuse out, and its place be taken by heavy fluid till the hydrate has reached its own level, where it will rest, its meshes then being filled, no longer simply by water, but by solution of the same specific gravity as its own. I am at present investigating the composition of the silica hydrates by a process based on this method. W. J. SOLLAS.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The General Board of Studies propose to appoint Mr. J. J. Lister, M.A., of St. John's College, Assistant to the Superintendent of the Museum of Zoology and Comparative Anatomy (Mr. J. W. Clark) for a period of three years. He will give special attention to the preparation of a new Catalogue of the Museum.

The Mechanical Workshops Inquiry Syndicate make proposals which virtually amount to the establishing of an Engineering School and Laboratory under Prof. Ewing, by recommending an annual expenditure of some £700 for demonstrations and apparatus. Another Syndicate report in favour of reserving a considerable area of ground between the Chemical and the Physical Laboratories for buildings in which the Engineering School may be accommodated. But the erection of these buildings and their equipment with suitable plant depend on a handsome response being made to the appeal for funds from outside the University which Prof. Ewing has in contemplation. It is to be hoped that his energy and fervour in the cause of engineering education in Cambridge may be adequately rewarded by generous benefactions to the Engineering School.

The Sites Syndicate propose that the remainder of the ground available in the New Museums area should be assigned (1) to the necessary extension of the Cavendish Physical Laboratory; (2) to the Botanical Department for new class-rooms, &c.; (3) to the Departments of Medicine, Surgery, &c.; (4) to the Sedgwick Memorial Museum of Geology; and (5) to the temporary accommodation of the Classical and Modern Language Lecturers. The Syndicate have been unable to assign special rooms to the Lecturer in Geography.

SCIENTIFIC SERIALS.

American Journal of Science, February.—A solution of the aurora problem, by Prof. Frank H. Bigelow. The question considered is the location in space of the visible aurora arch and streamers, referred to the surface of the earth, as seen by an observer. The observations required to test the theory which is developed consist in measuring the angle of inclination of a streamer to the vertical plane passing through the station, together with the azimuth of the ray. A simple piece of apparatus, suitable for such measurements, is described. The problem is of importance, because it bears upon the physical connection between the sun and the earth, as communicated through the medium of the ether.—Columbite and tantalite from the Black Hills of South Dakota, by W. F. Headden. A full description is given of the constitution of these minerals.—Note on the geology of the Florida phosphate deposits, by N. H. Darton.—Record of a deep well at Lake Worth, Southern Florida, by the same author. The well penetrated the great sand mantle at Lake Worth, and extended down into the Vicksburg limestone to a depth of 1212 feet. The section obtained from the borings is an important one, inasmuch as it throws some light on the general stratigraphy of a portion of Florida of which little was hitherto known.—On the chemical composition of aurichalcite, by S. L. Penfield.—The compressibility of hot water and its solvent action on glass, by Carl Barus. As a general deduction from the experiments, the author infers that in many instances a definite dissociation temperature of the solid must first be surpassed before solution will set in.—An attempt to harmonize some apparently conflicting views of Lake Superior stratigraphy, by S. R. Van Hise.—Powellite calcium molybdate, a new mineral species, by W. H. Melville.—Brückner's "Klimaschwankungen," by Frank Waldo. This is an extended review of Dr. Edward Brückner's important work on oscillations of climate, published last year.—The gigantic Ceratopsidæ, or horned Dinosaurs of North America, by O. C. Marsh (with ten plates); read at the Leeds meeting of the British Association for the Advancement of Science, 1890.

Bulletin de l'Académie Impériale des Sciences de St. Pétersbourg, new series, vol. i. No. 4.—On the products of condensation of benzaldehyde and the phenols, by A. Rusanoff (in German).—List of the (thirteen) *Scotylus* species in the Museum of the Academy, by P. Shevyreff Two species (*S. ventrosus* and *S. unispinosus*) are new.—On some observations made by Winnecke at Pulkova with the meridian circle in 1861–63, by O. Backlund (in German).—

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New anemograph and anemoscope, by H. Wild (in German). The former has been at work at St. Petersburg since 1887, and gives satisfactory results; the second, which is a simplification of the former, has been in use at St. Petersburg and Pavlovsk for more than ten years, and also works quite satisfactorily.—On the law of reciprocity of quadratic residues, note by Ed. Lucas (in French).—On the structure of nerve-filaments, by Ph. Owsjannikoff.—Apocryphal Acts of Apostles in Coptic language, by O Lemm (in German).

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 5.—"On a Membrane lining the Fossa Patellaris of the Corpus Vitreum." By Prof. T. P. Anderson Stuart.

The existence of a membrane here had been the subject of discussion *pro* and *con.* till 1886–87, when the matter was considered by some to have been finally set at rest by Schwalbe, who decided against it in very clear and explicit terms. According to his description the vitreous jelly itself lies against the lens capsule and forms the posterior boundary of the canal of Petit—if such it could be called, for the canal, he says, is merely to be compared with the other clefts in the vitreus. Any membrane that had been seen he declares to be an artificial product, the result of the action of reagents. The author finds, however, that in the perfectly fresh, unaltered eye, after the removal of the lens in its capsule, there may be raised off the surface of the jelly a membrane which, when stained and mounted, does not show any structure. When the membrane from the four-year-old ox eye was isolated and tied over the mouth of a test-tube ½ inch wide, it sustained a column of water 40 inches high. A smaller column than this may be sustained for days together. When isolated, it may be dried to form a delicate membrane. It is thinner in the centre where it lies against the lens capsule, thicker peripherally where it forms the posterior wall of the canal of Petit, which is thus a true canal. Thus, when the entire vitreus is squeezed, the centre of the anterior face bulges more than the periphery. The line of demarcation of the two parts is fairly sharp. The sun's rays concentrated upon it show fluorescence as marked as in the case of the hyaloid, and at a puncture the sharp fluorescent edge is strikingly different from the jelly showing through the hole. Treated with picrocarmine by the Gross method (to be described in the next number of the *Journal of Anatomy and Physiology*), the membrane is red, the jelly is yellow, and now its wrinkles are seen just as in the case of the hyaloid. In successful meridional sections the membrane is seen *in situ.* For ophthalmological practice, a knowledge of the existence of the membrane is most important, and the observations of ophthalmologists strongly support the author's observations.

"On the Connection between the Suspensory Ligament of the Crystalline Lens and the Lens Capsule." By Prof. T. P. Anderson Stuart.

The common teaching is that there is a direct continuity of substance between the suspensory ligament and the capsule of the lens, but an observation by the author of the paper seems to indicate that the ligament is only cemented to the capsule. On opening eye-balls in an advanced state of decomposition—putrid—he found the lens in its capsule perfectly free, and no indication of any rupture of tissue along the line of attachment of the suspensory ligament. This ligament was found perfectly intact projecting from the collapsed vitreus body as a sort of frilled ring with a free edge. These points are best seen after the Gross staining of the structures, as described by the author in the next number of the *Journal of Anatomy and Physiology.* The observation bears upon the still unsettled question of the development of the lens capsule, and upon cases of detachment of the ligament from the capsule sometimes met in ophthalmological practice; also on cases of atrophy and solution of the suspensory ligament, and cases of luxation of the lens.

"A Simple Mode of Demonstrating how the Form of the Thorax is partly determined by Gravitation." By Prof. T. P. Anderson Stuart.

Remembering how constant and how potent is the action of gravitation, and arguing that the segments of the thorax were so many rings of more or less elastic matter, the author concluded that, if similar rings of any other elastic material were suspended in the same way, the form of the thoracic segments should be reproduced, provided there intervened no other condition strong enough to counteract the action of gravitation. The author has found crinoline steel most convenient, though bands of paper do very well. The form of the thoracic segment of the quadruped, of the human fœtus, and of the human adult, are reproduced in succession if the ring be held between finger and thumb, and turned, from lying in the vertical, till it lies in the horizontal plane. The complete reproduction of the different features of the adult human thorax at its most characteristic level is most striking. This is when the steel, as usually sold, is about 6 feet long and ½ inch wide. As the ring is made smaller, the forms of the higher segments appear in succession. The points which are thus reproduced are so numerous and simultaneous that the author cannot believe them to be mere coincidences, and he therefore concludes that gravitation has had a greater influence in determining the typical form of the thorax than would be generally admitted. This is supported by the shapes assumed by the steel rings when the mode of suspension is varied from the normal, as in deformities of the vertebræ: here the particular form in the individual—the thoracic deformity—is more or less accurately reproduced.

Physical Society, February 13.—Annual General Meeting.—Prof. A. W. Reinold, F.R.S., Past-President, in the chair.—The reports of the Council and Treasurer were read and approved. From the former it appears that there has been a satisfactory increase in the number of members, and in the average attendance at the meetings. During the year a translation of Prof. Van der Waals's memoir on the continuity of the liquid and gaseous states of matter has been issued to members, and it is hoped that the translation of Volta's works, now in hand, will be published before the next general meeting. The Council regret the loss, by death, of Mr. W. H. Snell and Mr. W. Lant Carpenter, and obituary notices of these late members accompany the report. The Treasurer's statement shows that the financial condition of the Society is very satisfactory, and that the sales of the Society's publications have increased considerably.—A vote of thanks, proposed by Mr. Whipple and seconded by Dr. Gladstone, was unanimously accorded to the Lords of the Committee of Council on Education for the use of the room and apparatus. Dr. Atkinson proposed a vote of thanks to the auditors, Prof. Fuller and Dr. Fison, which was seconded by Dr. Thompson, and passed unanimously. The proposer, in referring to the satisfactory nature of the accounts, recommended that the publications of the Society should be brought before physicists and other students of physical science, and Dr. Thompson heartily concurred in this recommendation. A third unanimous vote was accorded to the President and Officers for their services during the past year, the proposer and seconder being Dr. Waller and Prof. Minchin.—The following gentlemen were declared duly elected to form the new Council: President: Prof. W. E. Ayrton, F.R.S.; Vice-Presidents: Dr. E. Atkinson, Walter Baily, Prof. O. J. Lodge, F.R.S., Prof. S. P. Thompson; Secretaries: Prof. J. Perry, F.R.S., T. H. Blakesley; Treasurer: Prof. A. W. Rücker, F.R.S.; Demonstrator: C. V. Boys, F.R.S.; other members of Council:—Shelford Bidwell, F.R.S., W. H. Coffin, Major-General E. R. Festing, R.E., F.R.S., Prof. G. F. Fitzgerald, F.R.S., Prof. J. V. Jones, Rev. F. J. Smith, Prof. W. Stroud, H. Tomlinson, F.R.S., G. M. Whipple, James Wimshurst.—The meeting was then resolved into an ordinary science meeting, and a paper on the change in the absorption spectrum of cobalt glass produced by heat, by Sir John Conroy, Bart., was read by Mr. Blakesley. The absorption spectrum of cobalt glass, when cold, consists of three dark bands in the red, yellow, and green, with a considerable amount of absorption between the first two. When a piece is heated to nearly red heat, the absorption between the first two dark bands diminishes, and the band in the red moves towards the least refrangible end of the spectrum, whilst those in the yellow and green retain their position, but become less distinct. During the heating of the glass the intensity of its colour diminishes, and as the glass cools its original colour and absorption spectrum returns. Diagrams and numbers showing the character and positions of the bands in hot and cold glass accompany the paper, together with the numbers obtained by Dr. W. J. Russell (Proc. Roy. Soc., xxxii. p. 258) for cold cobalt glass. In conclusion, the author says that these observations, and those of Feussner on solutions, show that the absorption spectra of some substances vary with temperature. In solutions, this may be due to formation of different hydrates or to partial dissociation, but in a

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